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EX PARTE OR LATE FILED

October 10, 1996

Mr. William F. Caton  
Acting Secretary  
Federal Communications Commission  
1919 M Street, N.W., Room 222  
Washington, DC 20554

RECEIVED  
OCT 10 1996  
Federal Communications Commission  
Office of Secretary

Re: Ex parte presentation in RM-8811, ET Docket  
No. 95-183, RM-8553, PP Docket No. 93-253,  
ET Docket No. 94-124, RM-8308

Dear Mr. Caton:

Pursuant to Section 1.1206 of the Commission's rules and regulations, Motorola Satellite Communications, Inc. ("Motorola") hereby reports that an ex parte presentation was made on September 26, 1996 by representatives of Motorola to the following:

Karl Kensinger .....	International Bureau
John Williams .....	Office of Plans and Policy
Ronald Netro .....	Wireless Telecommunications Bureau
Steve Sharkey .....	Office of Engineering and Technology
Michael Marcus .....	Office of Engineering and Technology
Joe Heaps .....	Office of Engineering and Technology
Harry Ng .....	International Bureau

In that presentation, the Motorola representatives presented and discussed the attached document. They also discussed Motorola's position in the above-captioned proceedings, as that position has been set forth in Motorola's pleadings in these proceedings. Specifically, the Motorola representatives analyzed the spectrum needs of satellite systems in the frequencies implicated in these proceedings.

W. F. Caton  
W. F. Caton

Mr. William F. Caton

October 10, 1996

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Three originals and three copies of this letter are being submitted for inclusion in the above-referenced dockets.

Sincerely,

A handwritten signature in black ink, appearing to read 'Pantelis Michalopoulos', written in a cursive style.

Pantelis Michalopoulos  
Attorney for Motorola Satellite  
Communications, Inc.

Attachment

cc: Mr. Karl Kensinger  
Mr. John Williams  
Mr. Ronald Netro  
Mr. Steve Sharkey  
Mr. Michael Marcus  
Mr. Joe Heaps  
Mr. Harry Ng



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# **The M-Star System**

**A Global Network of Non-Geostationary Communications  
Satellites Providing Broadband Services  
in the 40 GHz Band**

**Filed 4 September 1996 by:  
Motorola Satellite Systems, Inc.**



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# Agenda

- **System Description**
- **Business Plan**
- **Spectrum Requirements**
- **Sharing Analysis - Fixed Systems**
- **Sharing With Other Systems**
- **Sharing Rules**
- **Summary**



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## **M-Star System Description**

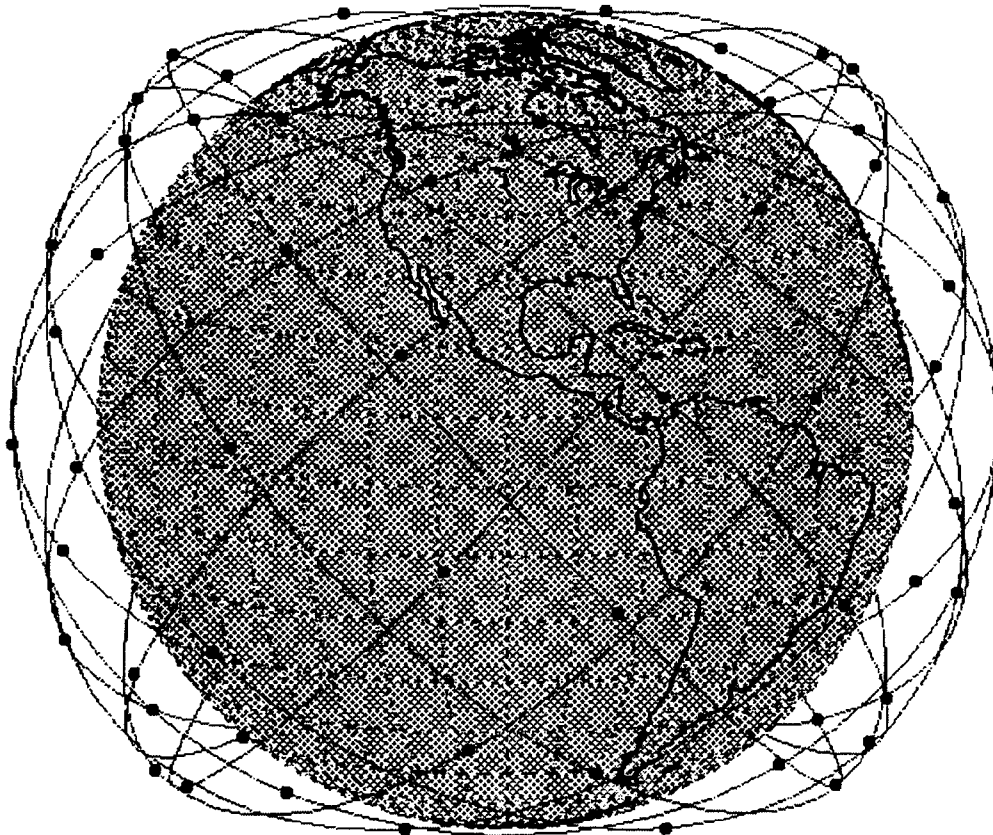
- **Non-GSO Global satellite system comprising 72 satellites.**
- **Real-time wide-band information transfer**
  - ⇒ **Voice, Data, Digital Video, and Audio.**
  - ⇒ **Covering protocols such as ISDN, Frame Relay, X.25, TCP/IP, ATM, FDDI, and OC-1.**
- **Data rates from 2.048 Mbps to 51.84 Mbps.**



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# M-Star



Number of Planes:	12
Satellites per Plane:	6
Inclination:	47°
Altitude:	1350 km
Argument of Perigee:	0°
Eccentricity:	0.0013
Plane Spacing at Equator:	30°
Plane Phasing:	+25°
Minimum elevation Angle:	22°
Orbit Period:	6761 seconds

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# M-Star Communications

Parameter Description	WAG/ E- 1 Specification	HBR Specification
Modulation Format	QPSK	QPSK
Coding	Convolutional Concatenated With Reed Solomon	Convolutional Concatenated With Reed Solomon
Target Bit Error Rate	$10^{-6}$	$10^{-9}$
Data Rates (information)	2.048 Mbps	51.84 Mbps
Downlink Bandwidth	3 GHz	3 GHz
Uplink Bandwidth	3 GHz	3 GHz
Eb/ No requirement	2.2 dB	2.7 dB
Ground Station RF Power Amplifier	up to 7.9 W for E- 1 Terminals	up to 46.2 W for MTSO Terminals to Cell Site  up to 79.5 W for HBR Terminals
Ground Terminal Aperture (m)	0.66	1.5
Ground Terminal Figure of Merit G/T	19.3 dB/ K	26.4 dB/ K



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## **Business Plan**

**M-Star will provide**

- **Competitively priced regional and global communication**
- **Ready to use broadband infrastructure by 2000**
  - ⇒ **Lower total cost than global fiber networks**
  - ⇒ **Less time to build than a global fiber network**
- **Enhanced competition in telecommunication markets**



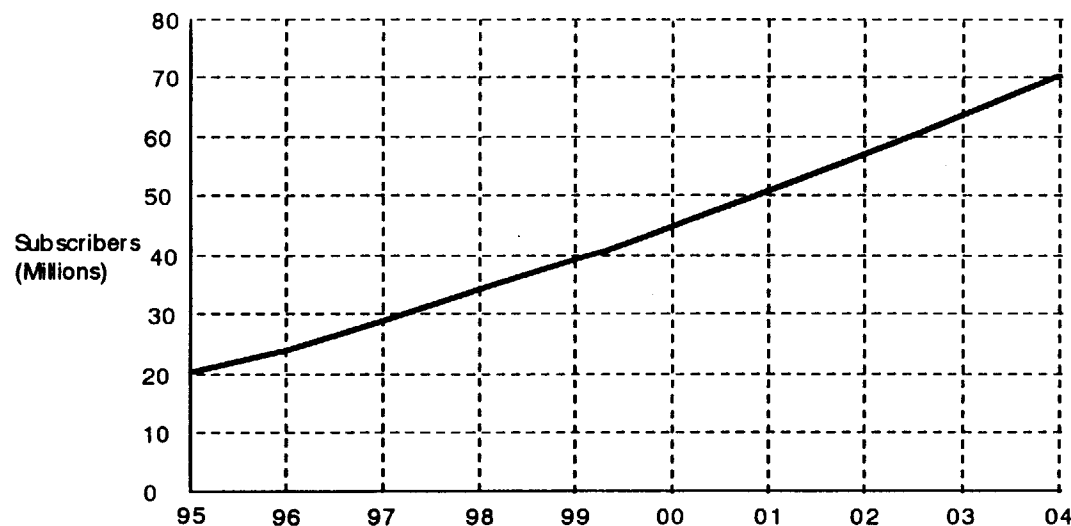


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## Market & Demand for Services

- Third generation wireless services will include several advanced forms of voice and data communications transmitted from pocket sized telephones, wireless facsimile machines and other portable devices



The growth of wireless subscribers forecasted by the Yankee Group (Reference: "PCS: The Implementation Phase", the Yankee Group, February 1995).



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## **Market & Demand for Services**

- **M-Star provides for the interconnection between backhauls**
- **M-Star provides for LAN - LAN direct connections**
- **M-Star provides for small services connectivity or an aggregate of service providers (E-1)**



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## **M-Star Spectrum Plan**

- **Service Links:**

37.5 - 40.5 GHz (Space-to-Earth)

47.2 - 50.2 GHz (Earth-to-Space)

- **Inter-Satellite Links:**

59.0 - 64.0 GHz

- **TT&C Links will operate in the service link band**

⇒ **Launch and emergency operations in FSS band below 18 GHz**



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# M-Star Satellite Capacity

- **Traffic Capacity**
  - ⇒ **The distribution of end users will create high peak demands on the system. These peak demands are a key determinant of the overall spectrum requirements.**
  - ⇒ **High peak traffic demands are managed by the use of a LEO Constellation, a versatile satellite payload and an antenna designed to create relative small beam coverage areas in the satellite coverage footprint.**
  - ⇒ **A single space vehicle will support as many as 1800 E-1 links and 16 OC-1 links.**



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# M-Star Typical Spectrum Requirements

- **Town & Small City**
  - ⇒ **250 E-1 links/town**
  - ⇒ **25 E-1 links/transponder**
  - ⇒ **1 OC-1 link/town**
  - ⇒ **90 MHz/transponder**
  - ⇒ **990 MHz per town**
- **Large City**
  - ⇒ **450 E-1 links/city**
  - ⇒ **25 E-1 links/transponder**
  - ⇒ **15 OC-1 links/city**
  - ⇒ **90 MHz/transponder**
  - ⇒ **2970 MHz/city**

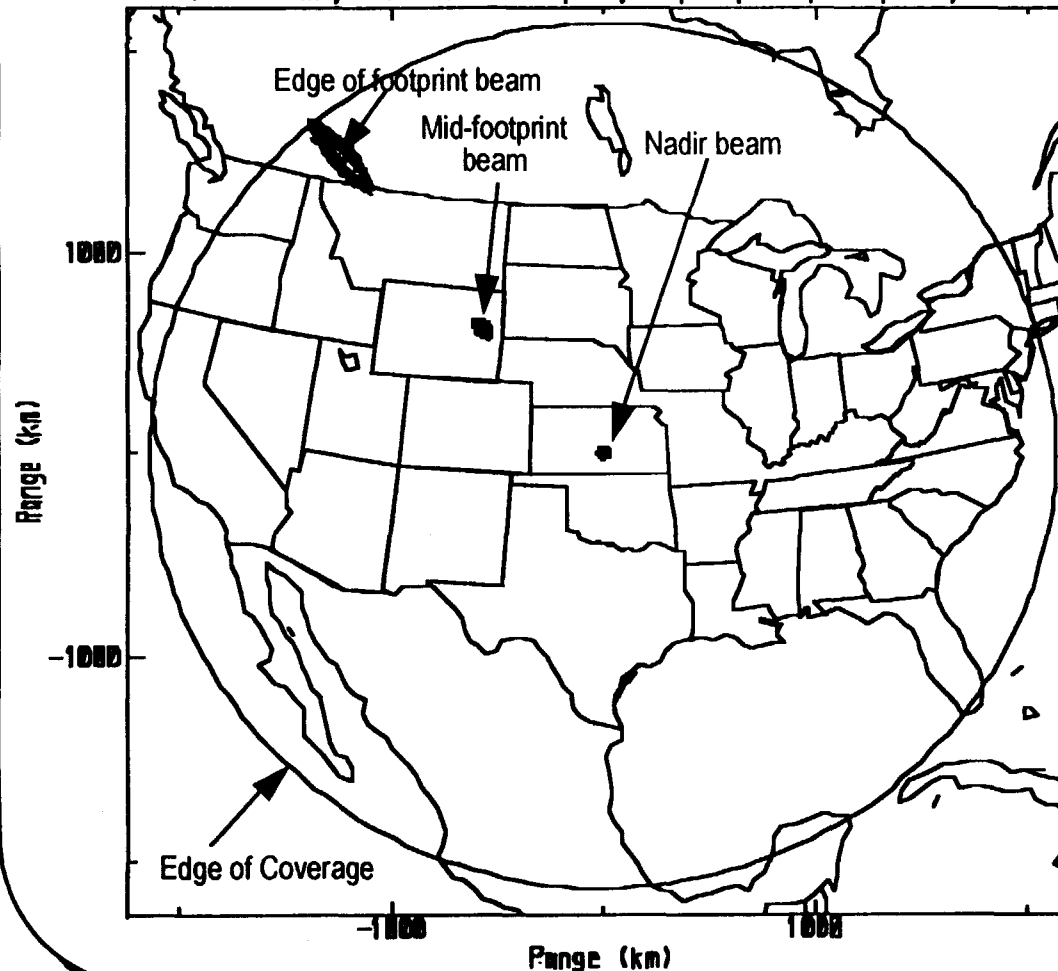


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## **M-Star Satellite Footprint**

SV at 1350 km; Contours at -2, -4, -6, -8, -10, -14, -18, -22 dB



QPSK Modulation, Convolutional Coding  
concatenated with R/S

### **E1 Links**

BER 10<sup>-6</sup>  
Eb/No 2.2 dB  
Rate 2.048 Mbps  
BW 3 GHz  
Xmit Antenna 0.66 m 7.9 W  
Rx Antenna G/T=19.3 dB/K

### **OC-1 Links**

BER 10<sup>-9</sup>  
Eb/No 2.7 dB  
Rate 51.84 Mbps  
BW 3 GHz  
Xmit Antenna 1.5 m 46.2 to 79.5 W  
Rx Antenna G/T=26.4 dB/K



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## **Sharing with Fixed Service**

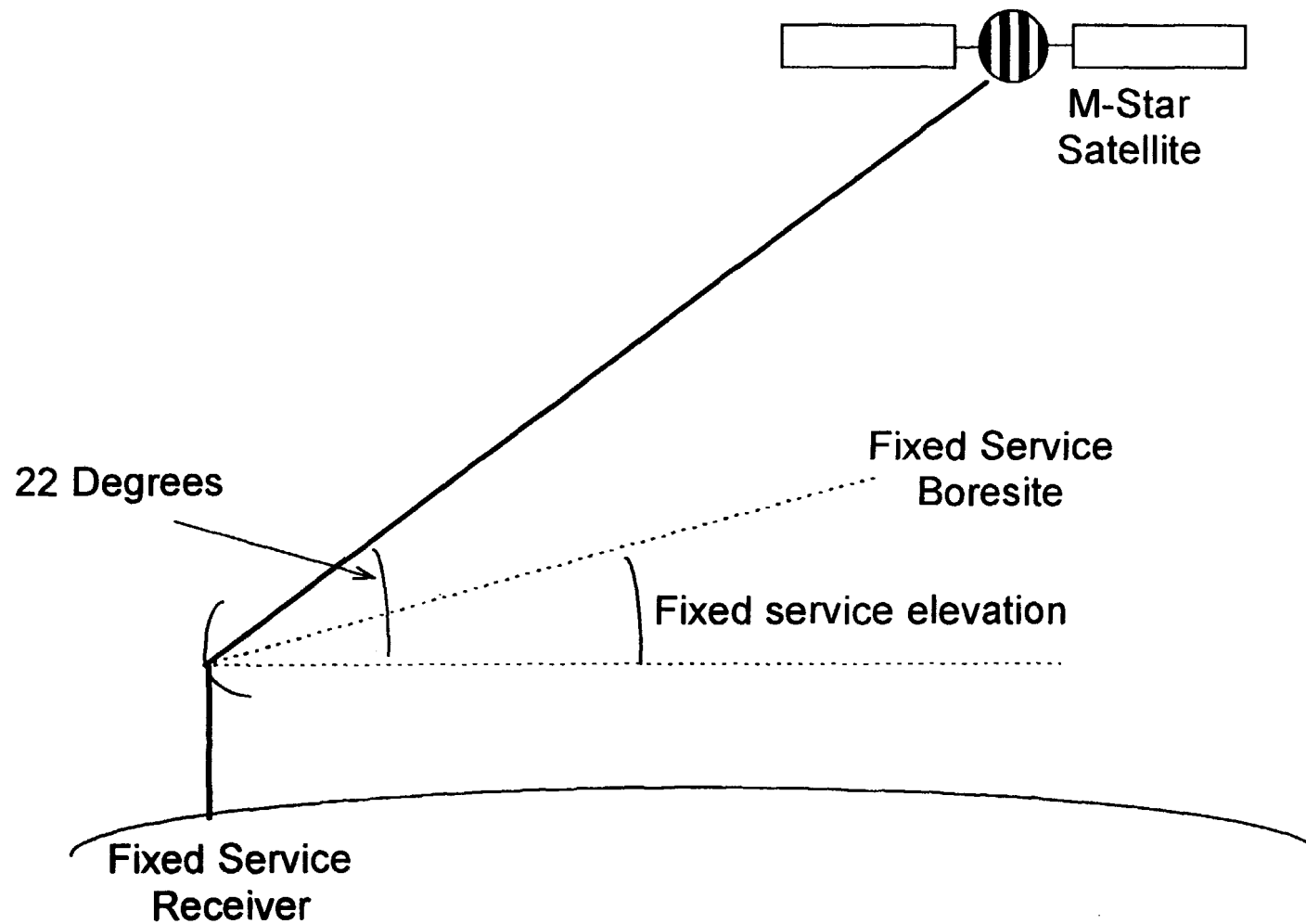
- **M-Star into Fixed Service**
  - ⇒ 37.5 - 40.5 GHz band (Sharing with Satellites).
  - ⇒ 47.2 - 50.2 GHz band (Sharing with Earth Stations).
  
- **Fixed Service interference into M-Star**
  - ⇒ 37.5 - 40.5 GHz band (Sharing with Earth Stations).
  - ⇒ 47.2 - 50.2 GHz band (Sharing with Satellites).



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Geometry of M-Star Downlink  
into Fixed Service at 40 GHz







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## **M-Star Satellites into FS (37.5 - 40.5 GHz)**

- **M-Star is below 47 CFR 25.208(c) PFD limits**
- **Downlink calculations show that the peak Io/  
No interference level experienced by the  
Fixed Service is -14.2 dB.**
- **M-Star downlink can share without  
coordination.**

**MOTOROLA****Satellite Communications Division****Analysis Details of M-Star  
Downlink into Fixed Service  
at 40 GHz****PEAK IMPACT OF M-STAR DOWNLINK**

	Cell Site	OC-1 (MTSO)	OC-1 (Server)
FS Elevation Angle (deg)	Io/No (dB)	Io/No (dB)	Io/No (dB)
0	-44.9	-40.2	-42.7
5	-42.1	-37.4	-39.9
10	-38.4	-33.6	-36.1
15	-32.5	-27.8	-30.3
20	-18.9	-14.2	-16.7

**M-STAR TRANSMITTER PARAMETERS (Cell Site)**

Power Radiated	W	0.02
Output losses	dB	1.50
Carrier frequency	GHz	40
Information rate	Mbps	10.24
Pwr spectral density	dBW/Hz	-88.59
Antenna boresite gain	dBi	40.60
Off boresite angle	deg	0
Off boresite gain	dBi	40.60
EIRP (boresite)	dBW	22.11
EIRPSD (off boresite)	dBW/Hz	-47.99

**CHANNEL PARAMETERS**

Distance	km	2585.9
Total absorption	dB	1.80
Spreading loss	dB	192.74

**FS RECEIVER PARAMETERS**

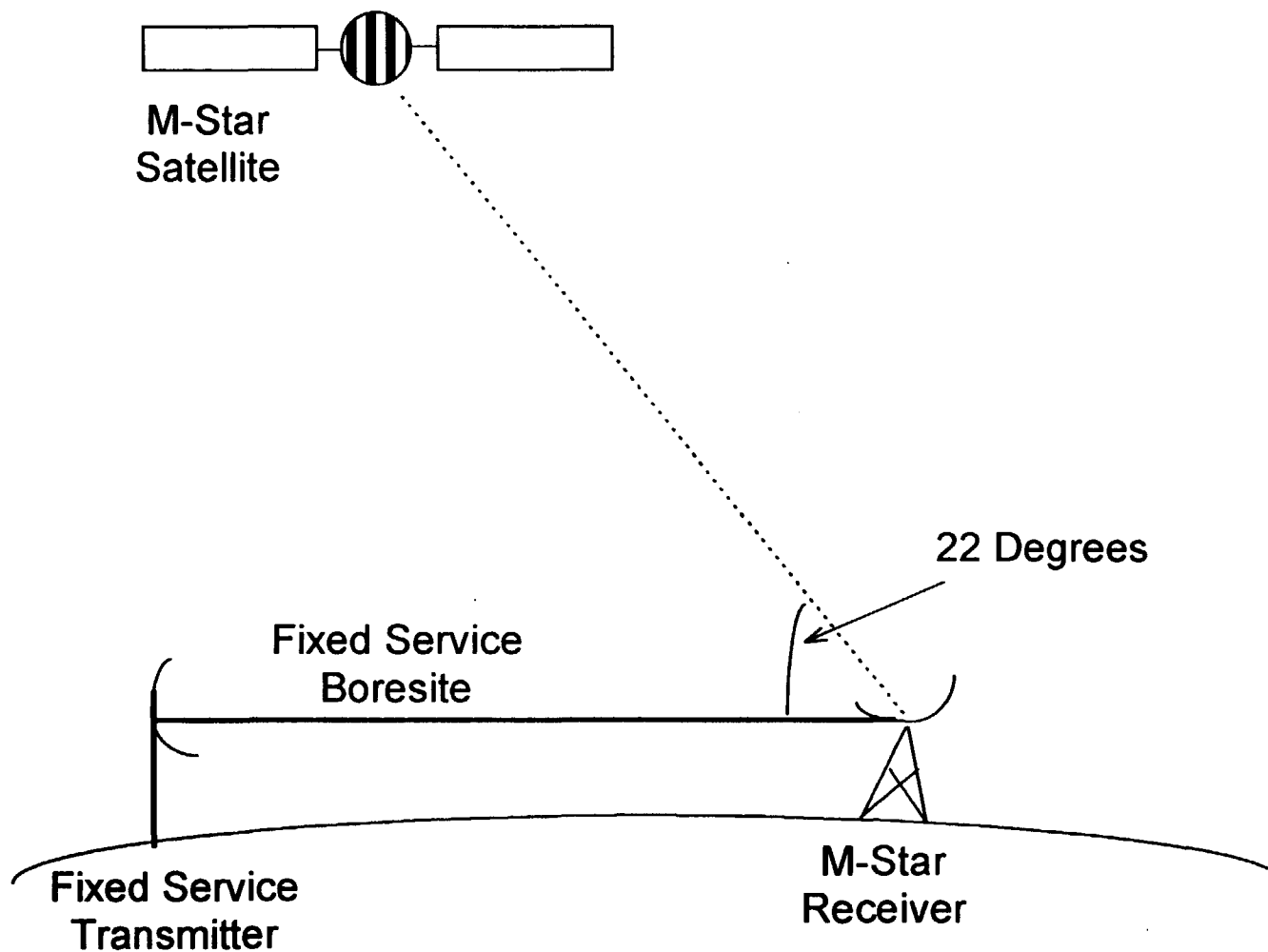
System temperature	K	1000
No	dBW/Hz	-198.60
Off boresite angle	degrees	2
Antenna diameter	m	0.66
Antenna boresite gain	dBi	46.60
Off boresight gain	dBi	25.03
Io	dBW/Hz	-217.50
Io/No	dB	-18.90



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Geometry of Fixed Service  
into M-Star Downlink at 40 GHz





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## **FS into M-Star Earth Stations (37.5 - 40.5 GHz)**

- **M-Star will accept interference from the Fixed Service located 1 km away at the level of  $I_o/N_o = -13$  dB.**
- **Sharing Rules:**

### **EIRP Limits:**

**For Fixed Service transmitters with clear air EIRP density less than  $-28.4$  dBW/MHz no coordination required. Fixed Service can exceed this limit by means of adaptive power control only to the extent where link propagation attenuation exceeds the clear air value due to precipitation.**

**Higher power terminals need to be coordinated.**

**MOTOROLA****Satellite Communications Division****Analysis Details of Fixed  
Service into M-Star Downlink  
at 40 GHz****FS RECEIVER**

Receiver Noise Temp	deg	1000		
No	dBW/Hz		-198.60	
Reqd Co/No	dB		8.00	
Margin	dB		6.00	
Rx antenna gain	dBi		46.59	
Max tx EIRP	W	0.05	dbW	-13.01
Channel NBW	MHz	5		
	MHz	20		

**BizTel Inc.  
(File No.: 4228-CF-P/L-24)**5 MHz  
Channel20 MHz  
Channel**FS CHANNEL**

Frequency	GHz	40		
Tx-Rx distance	km	7.36		7.36
Spreading loss	dB		141.82	141.82
Atmos. Absorption	dB/km	0.13	0.96	0.96
Total propagation loss	dB		142.77	142.77

**FS TRANSMITTER**

Reqd EIRP dens	dBW/Hz		-88.42	-88.42
Reqd EIRP	dBW/channel		-21.43	-15.41
Tx antenna gain	dBi		46.59	46.59
Reqd Power dens	dBW/Hz		-135.01	-135.01

5 MHz  
Channel20 MHz  
Channel**FSS CHANNEL**

Tx-Rx distance	km	1		
Spreading loss	dB		124.48	124.48
Atmos. Absorption	dB/km	0.13	0.13	0.13
Total path loss	dB		124.61	124.61

**FSS RECEIVER**

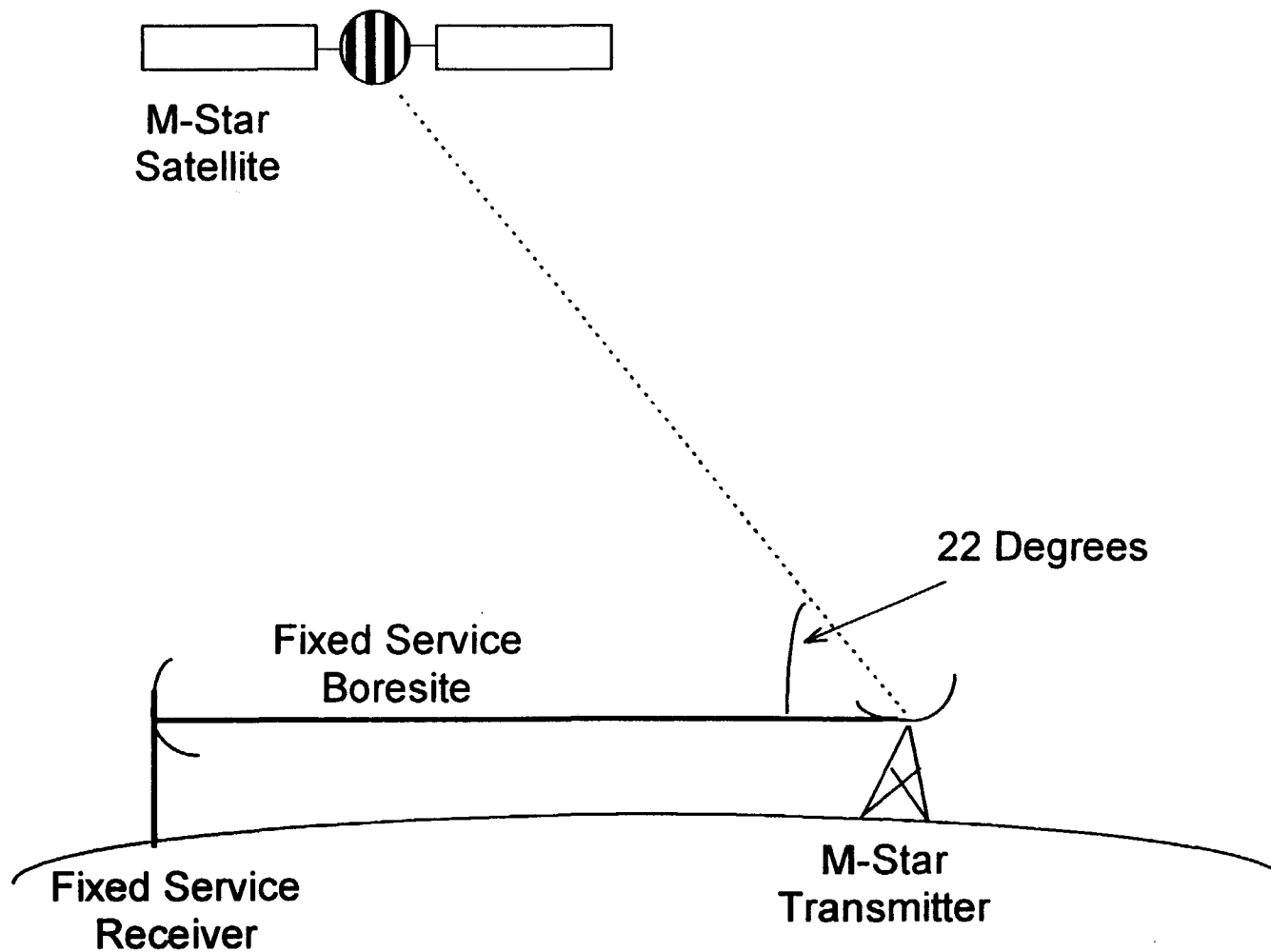
Rec. Noise Temp.	K	503		
No	dBW/Hz		-201.58	-201.58
Rx antenna gain	dBi		-1.56	-1.56
lo	dBW/Hz		-214.59	-214.59
lo/No	dB		-13.01	-13.01



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**Geometry of M-Star Earth Station  
Into Fixed Service at 50 GHz**





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## **M-Star Earth Stations into FS (47.2 - 50.2 GHz)**

- **M-Star is below EIRP limits of 47 CFR 25.204(b)**
- **Maximum required separation distance for Io/ No to be below -13 dB (5% rise in noise floor) is 69.2 km for Fixed Service main beam interactions.**
- **Coordination with Fixed Service will be required.**

**MOTOROLA****Satellite Communications Division****Analysis Details of M-Star  
Uplink into Fixed Service  
at 50 GHz****SEPARATION DISTANCE OF M-STAR UPLINK TO ACHIEVE  $I_o/N_o = -13$  dB**

	Cell Site	OC-1 (MTSO)	OC-1 (Server)
FS Azimuth Angle (deg)	Distance (km)	Distance (km)	Distance (km)
0	67.0	59.5	69.2
2.5	23.0	18.1	24.5
5	14.4	10.7	15.5
10	8.1	5.7	8.9
45	1.7	1.1	1.9

**M-STAR TRANSMITTER PARAMETERS (Cell Site)**

Power Radiated	W	1.5
Output losses	dB	0.50
Carrier frequency	GHz	50
Information rate	Mbps	10.24
Pwr spectral density	dBW/Hz	-68.84
Antenna boresite gain	dBi	49.30
Off boresite angle	deg	22
Off boresite gain	dBi	-1.56
EIRP (boresite)	dBW	50.56
EIRPSD (off boresite)	dBW/Hz	-70.40

**CHANNEL PARAMETERS**

Distance	km	67.00
Total absorption (0.4 dB/km)	dB	26.80
Spreading loss	dB	162.94

**FS RECEIVER PARAMETERS**

System temperature	K	1000
No	dBW/Hz	-198.60
Off boresite angle	degrees	0
Antenna diameter	m	0.66
Antenna boresite gain	dBi	48.53
Off boresight gain	dBi	48.53
$I_o$	dBW/Hz	-211.61
$I_o/N_o$	dB	-13.01





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**Geometry of Fixed Service into  
M-Star Uplink at 50 GHz**

